



Front end electronics for silicon tungsten calorimeter

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FRONT END ELECTRONICS FOR SILICON TUNGSTEN CALORIMETER

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PLAN

I– REQUIREMENTS

II– A DESIGN

III– ADAPTATIVE STAGE

IV– SHAPER

V– CODING

VI– FIRST IDEAS FOR ADC

CONCLUSION

I– REQUIREMENTS

**Maximum energy : up to 1 Tev.
=> bunch crossing 150ns.**

Time signal : between 20ns–60ns.

Train = 3000 bunch crossing.

One Train every 200ms.

Dynamic = signal/noise = 14–15 bits.

Accuracy: 0,4 % so 8 bits.

30 Millions channels with 4mW/channel max.

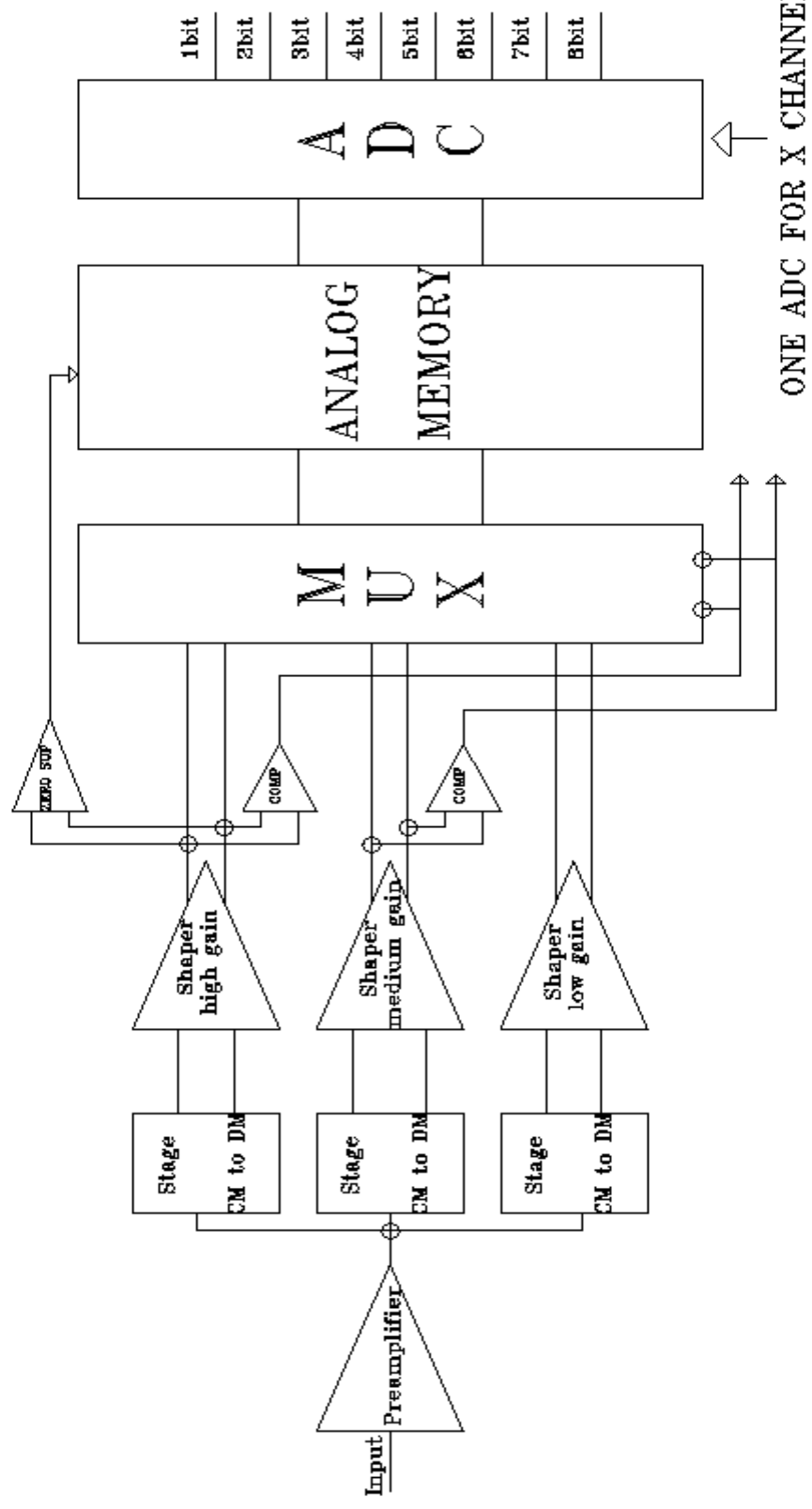
128 channels/chip so 240.000 chips.

SOME IDEAS

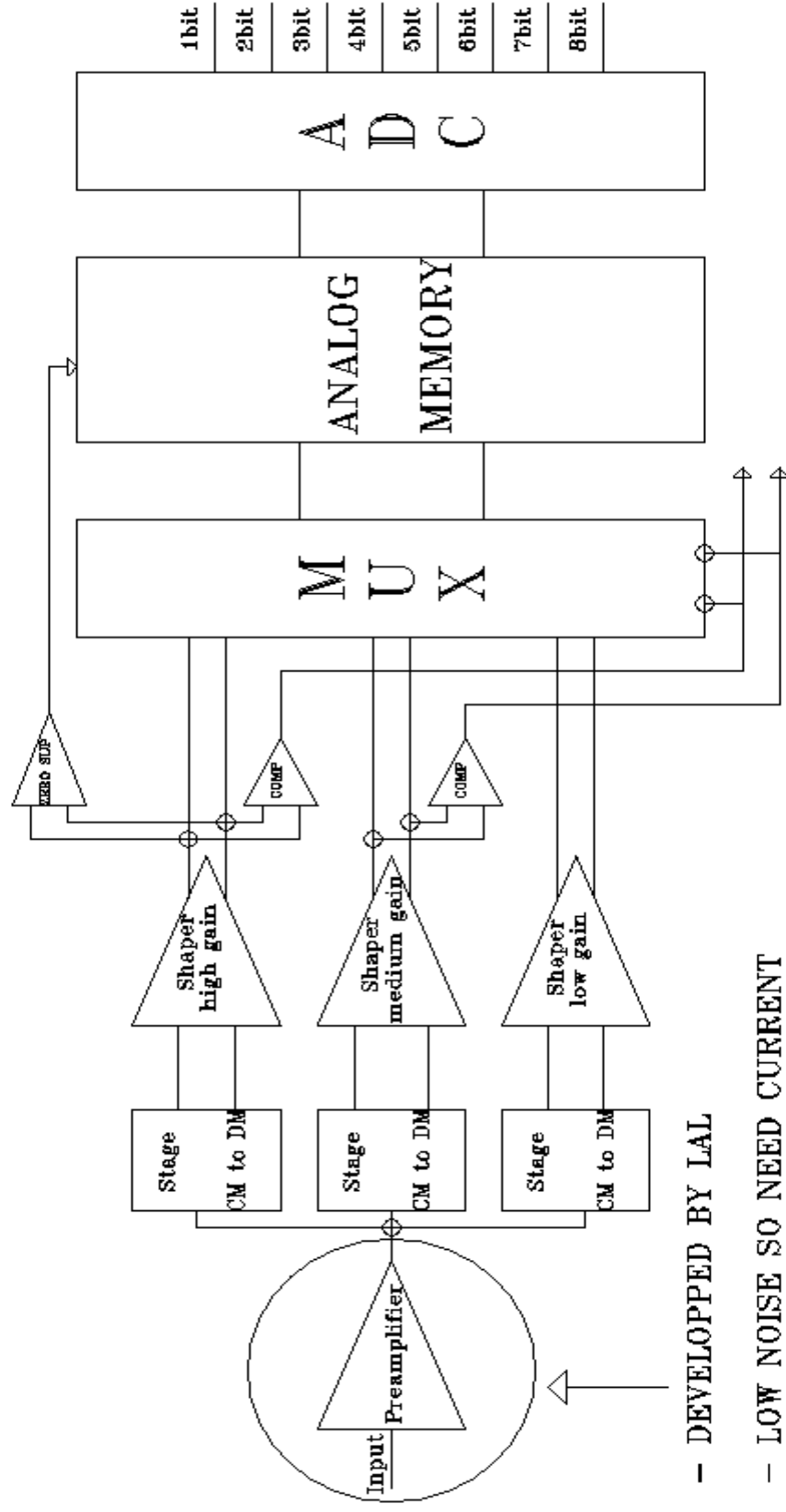
Accuracy < Dynamic so multi gain with choice of gain :

- No preamplifier with multi-gain : possibility??**
- Shaper multi-gain, V_{out} = energy.**
- Energy value only one measure.**

A DESIGN FOR SIGNAL TREATEMENT

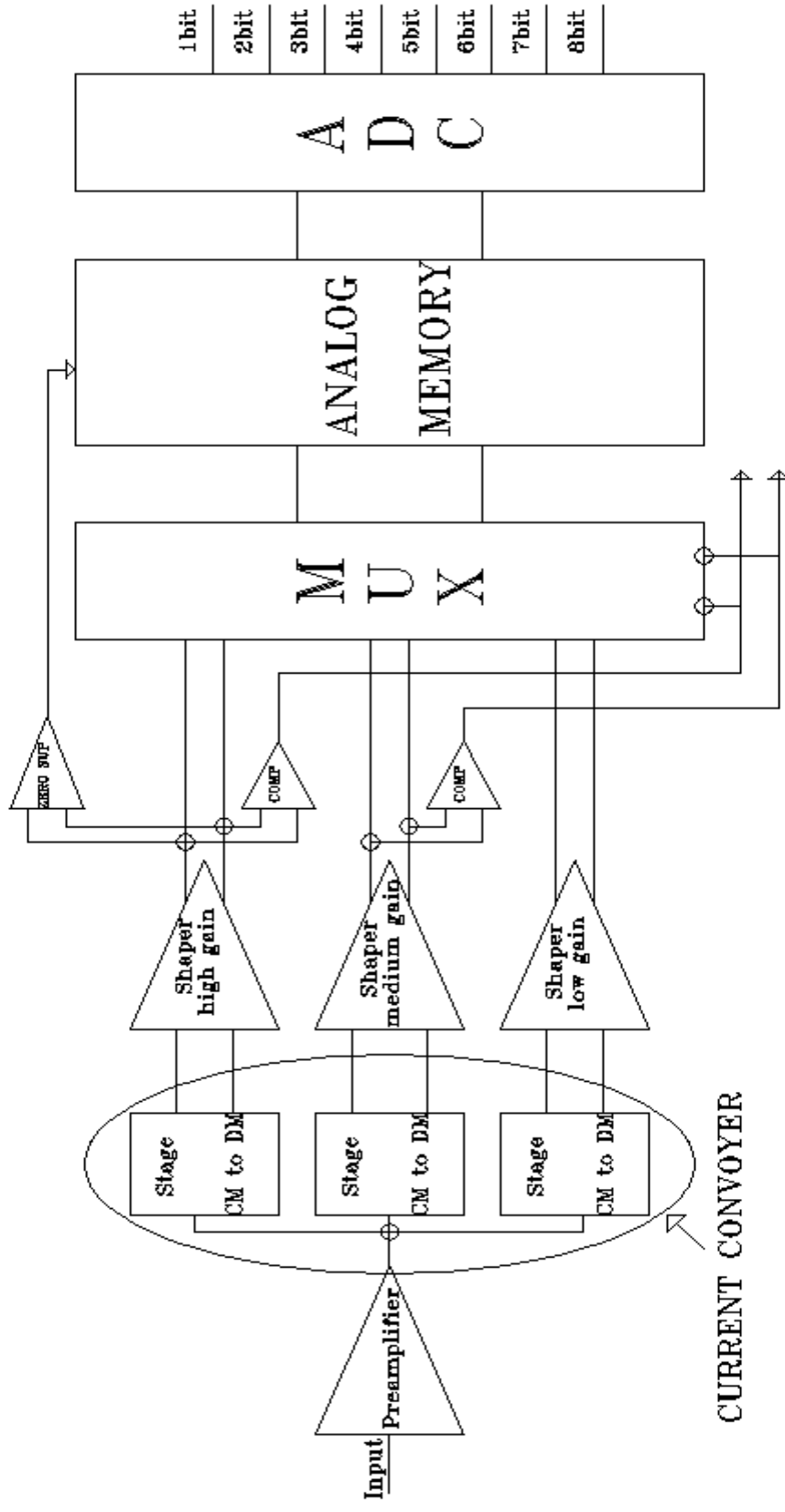


A DESIGN FOR SIGNAL TREATMENT

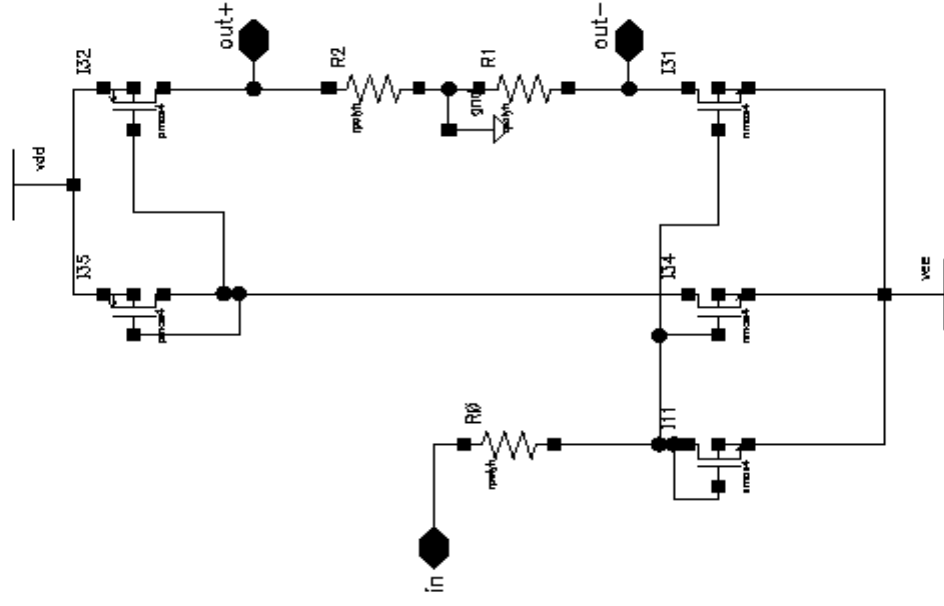


- DEVELOPPED BY LAL
- LOW NOISE SO NEED CURRENT

A DESIGN FOR SIGNAL TREATMENT



CURRENT CONVOYER

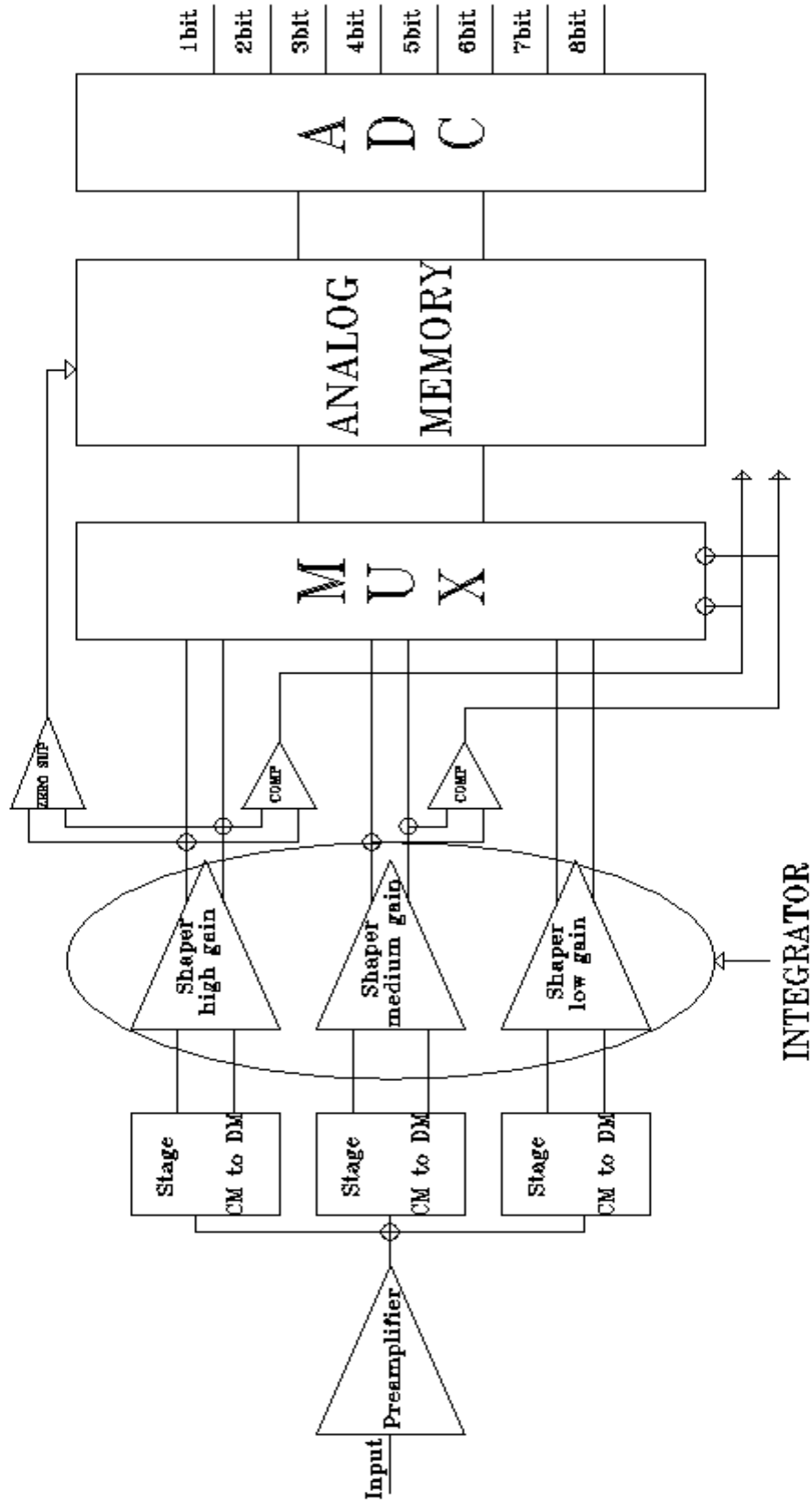


– COMMON MODE VOLTAGE INPUT

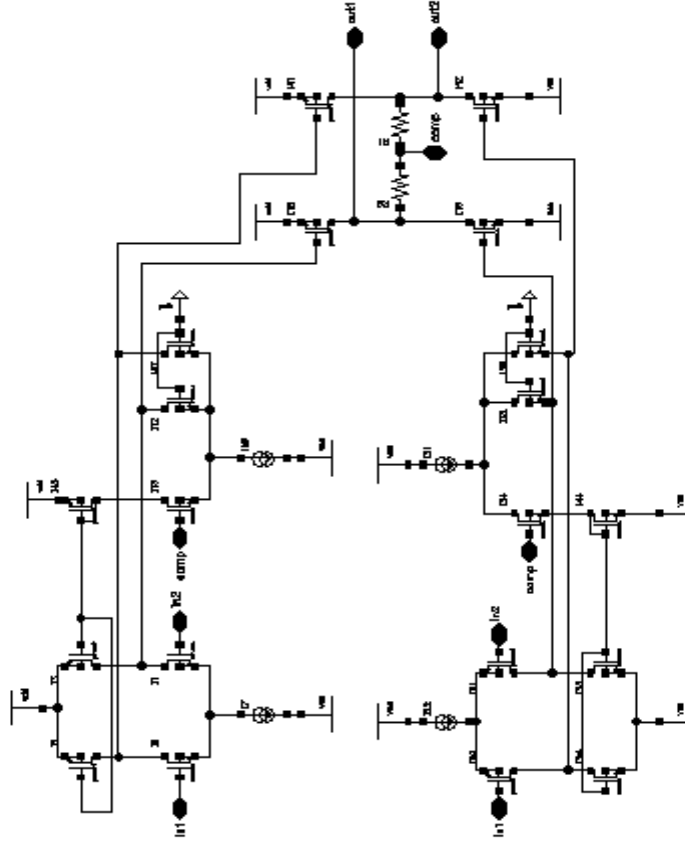
– DIFFERENTIAL MODE CURRENT OUTPUT

– TWO CURRENT MIRROR

A DESIGN FOR SIGNAL TREATMENT



AMPLIFIER

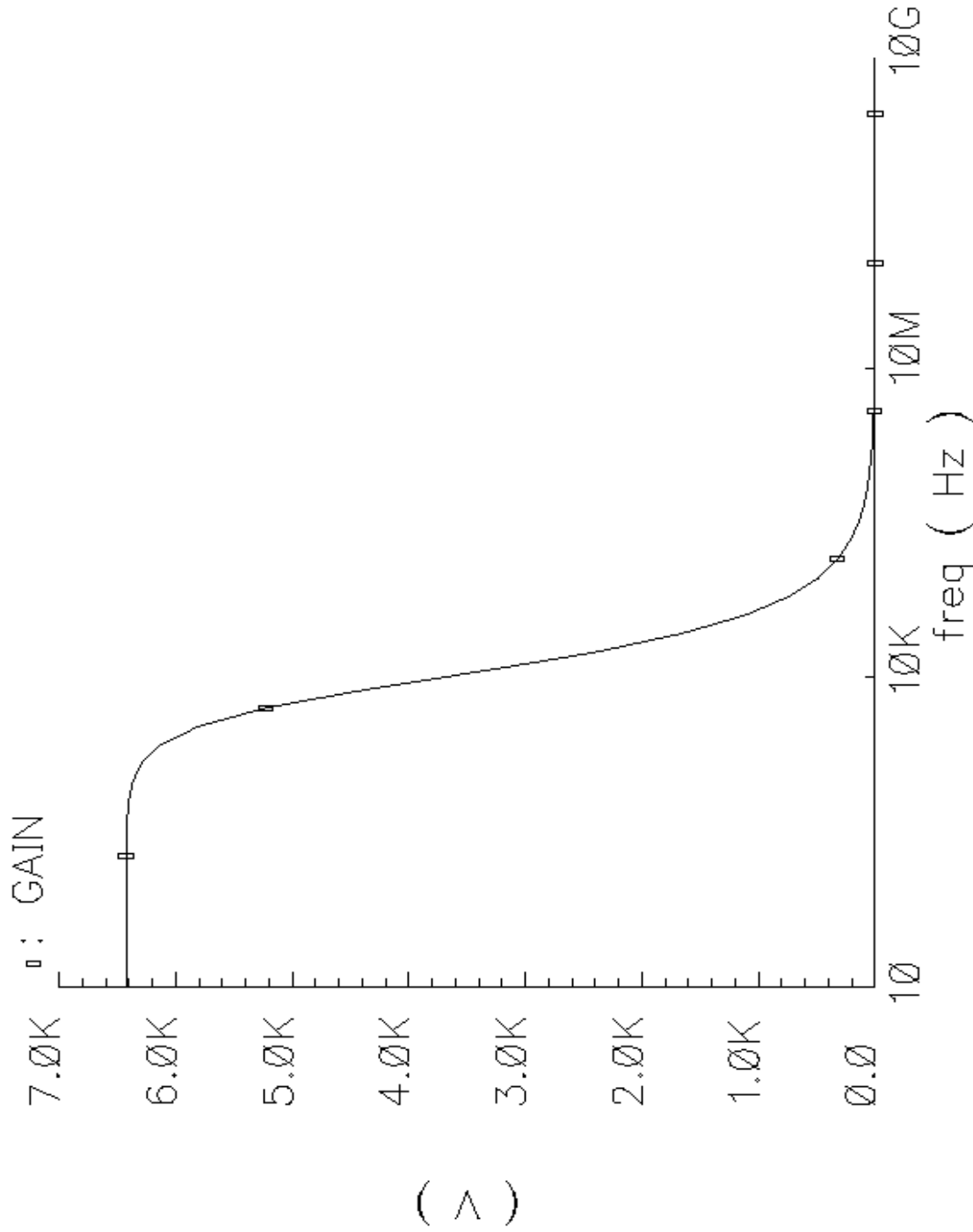


- LARGE DYNAMIC RANGE
- LOW POWER SUPPLY AND LOW CURRENT
- TWO DIFFERENTIAL PAIRS WITH ACTIVE LOAD
- COMMON MODE FEEDBACK
- OUTPUT RAIL TO RAIL
- CONSUMPTION : 250nA

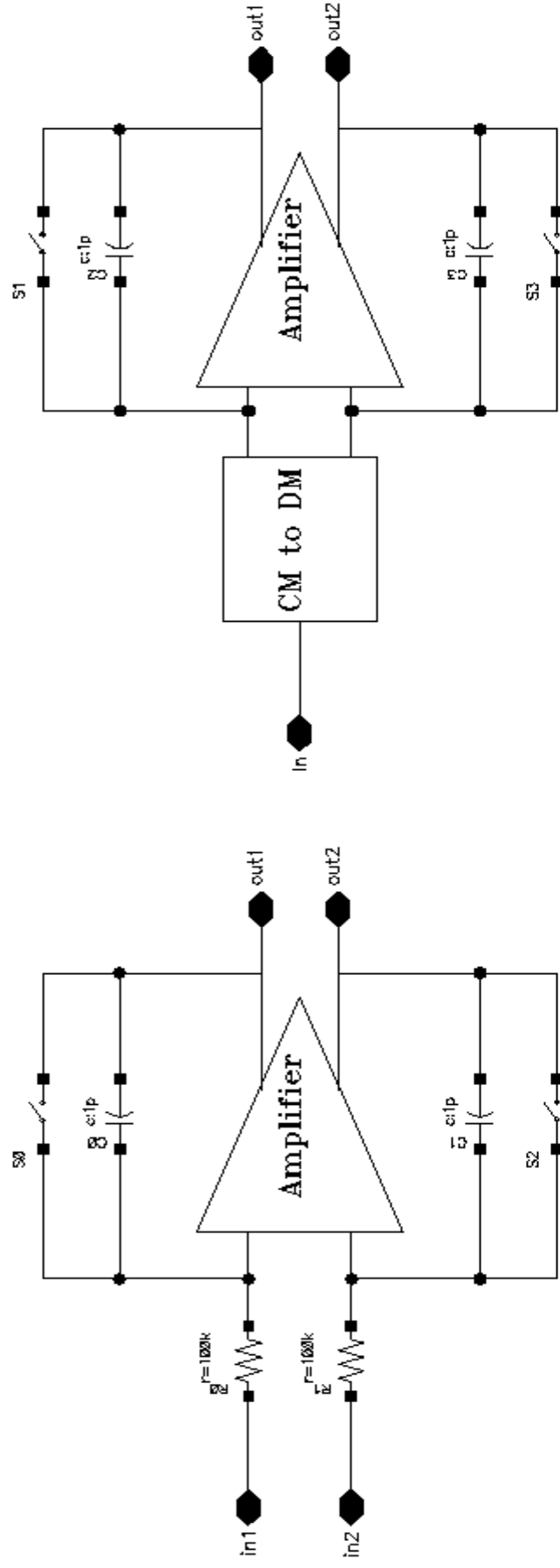
OPEN LOOP GAIN AMPLIFIER

Simulation results with spectre Cadence

1



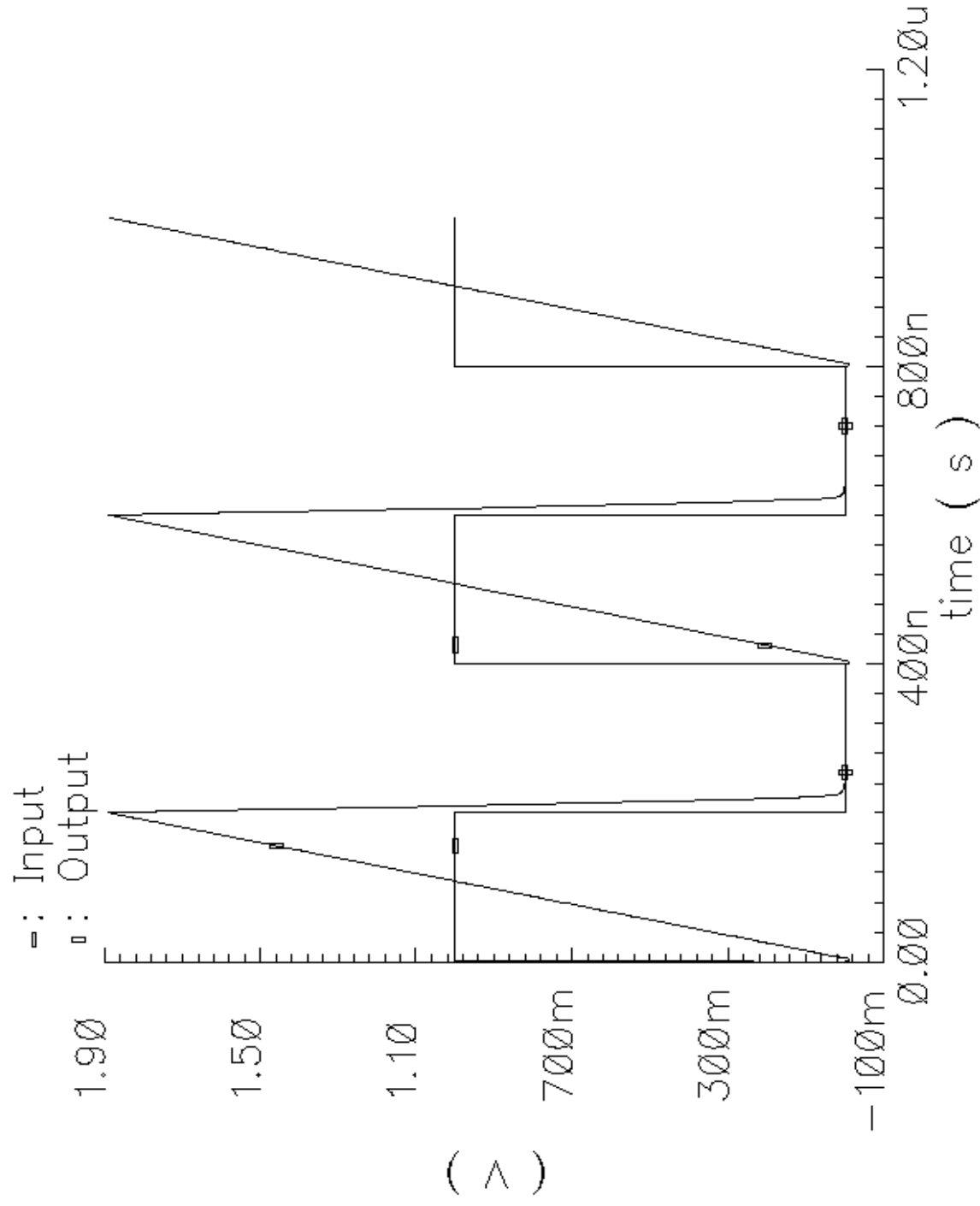
CHIP SEND 08/02/2002



SWITCHED INTEGRATOR

RESET TIME 20ns

1



V-CODING

Zero suppress with shaper high gain to have the better accuracy.

Channel identity (128 channels/chip).

Bunch crossing identity (3000 events).

Energy: analog memory (1 ADC for x channels).

ANALOG TO DIGITAL CONVERSION

- PRINCIPLE: if $V_{in} > V_{ref} \Rightarrow 1$
 then $(V_{in} - V_{ref}) * 2 = V1$

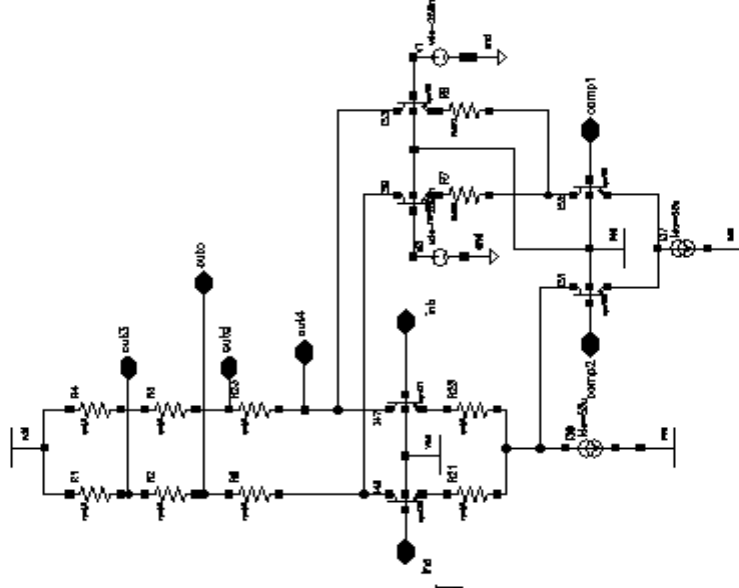
 if $V_{in} < V_{ref} \Rightarrow 0$
 then $V_{in} * 2 = V2$

- ADC 1 BIT: COMPARATOR BIPOLAR OR CMOS

- ONE STAGE TO DO SUBTRACTION AND MULTIPLICATION

- MULTIPLICATION BY 2: AMPLIFIER GAIN 2

- SUBTRACTION COMMANDED BY COMPARISON BEFORE



CONCLUSION

**Choice for technology : Cmos, SiGe...
For the moment AMS 0.8 μ m BiCMOS.**

Test amplifier verify good results.

**Stage common mode to differential mode
improve linearity.**

Consumption ADC : bipolar or cmos

Multiplexer, analog memory....

LAYOUT 02/2002

